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Application Based on

Docket **84588F-P**
Inventors: Gareth Bryn Evans and Peter Hewitson
Customer No. 01333

WASHING METHOD AND APPARATUS

MAIL STOP PATENT APPLICATION
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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Date: August 26, 2003

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P01/7700 0.00-0220263.8

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2. Patent application number *(The Patent office will fill in this part)* — **0220263.8** — 31 AUG 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

EASTMAN KODAK COMPANY
343 STATE STREET
ROCHESTER
NEW YORK 14650-2201
UNITED STATES OF AMERICA

Patents ADP number *(if you know it)* 423020001

If the applicant is a corporate body, give the country/state of its incorporation — **NEW JERSEY**

4. Title of the invention — **WASHING METHOD AND APPARATUS**

5. Name of your agent *(if you have one)* — **B BARKER**

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

KODAK LIMITED
PATENTS, W92-3A
HEADSTONE DRIVE
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Patents ADP number *(if you know it)* 7498678001

6. If you are declaring priority from one or more earlier patent applications, give the country and date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of Filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)

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c) any named applicant is a corporate body.

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Continuation sheets of this form	
Description	7
Claim(s)	2
Abstract	1
Drawing(s)	1 + 1 pl

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Priority Documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
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Washing Method and Apparatus

Field of the Invention

This invention relates to the washing of sheets of material which contain substances requiring washing for their removal. The invention relates in particular to the washing or stabilisation stage of the photographic processing of colour film and paper. The invention will be described with reference to a system for washing photographic paper.

Background of the Invention

There is a need in the photographic industry to remove substances from processed material to ensure image stability. In deep-tank replenished processing systems material passes from one tank to the next. For example, with respect to processing of colour paper, the material passes through a first tank for development, a second tank for bleach/fix and then into a series of wash or stabiliser tanks. The wash tanks are usually inter-connected so that clean washing solution is added to the last of the tank series and the over-flow from the last tank is transferred to the previous tank and so on. In this way the flow of solution is in a direction which is counter to the direction of transport of the paper. This so-called counter-current flow technique enables efficient washing since when the material has the highest content of substances to be removed, the wash solution also has the highest concentration of removed substances and clean solution is only used in the last step when the processed material contains little removable contaminants.

The table below is derived from a mathematical model which predicts the fraction of contaminants remaining in colour paper after a four-tank counter-current wash stage in which 194 ml/m^2 of solution is added to the last tank. High agitation is assumed which allows equilibrium between substances in the solution and processed material to be rapidly established.

	Counter-Current	Multiple Wash
Number of tanks	4	4
Fraction of material left	0.00067	0.00062
Total Volume (ml per m^2)	194	776
Total time @ 22.5 sec per tank	90	90

The technique of counter-current washing is widely if not universally adopted with small, so-called Minilab or Microlab equipment and is often also used in large-scale wholesale equipment. More efficient washing can be achieved if more tanks are used in a counter-current series. However, the tanks are bulky and require pumps to provide adequate re-circulation and agitation. Each additional tank incurs additional cost and maintenance.

Shorter washing times can be achieved if the time in each tank is reduced below that required for the material in the coating to be in equilibrium with the material in solution. This can be achieved without undue loss of washing efficiency. For example US 6106169 describes a multi-tank unit in which all but the last tank is insufficiently long to provide an immersion time sufficient to reach equilibrium. This unit was found to produce good results with a seven tank configuration giving a total wash-stage time of 20 seconds using as little as 9 ml/m^2 of solution.

By reducing the tank volumes, shaping them appropriately and allowing the paper to be transported with the coated side against the curved surface of the interior of the tanks, the agitation / re-circulation pumps could be avoided. However this arrangement required the provision of seven tanks with six cross-over devices to pass the paper from one tank to the next. Such cross-over devices, usually a set of at least two rollers, are expensive and require cleaning and maintenance.

An alternative approach to using curved surfaces in the above multi-stage unit is to use substantially planar, inclined surfaces. The so-called "Inclined Ramp" washing system, see EP 908767, provided a single plane at a 45° angle, to guide the paper in an upward direction with the coated side of the paper against

means providing a resistance to downward flow of the wash solution and having a capacity to hold wash solution in excess of that of a substantially smooth surface.

The invention further provides an apparatus for washing substances from a coated surface of a material, the apparatus comprising at least one inclined substantially planar surface along which the material is passed, an inlet for the introduction of wash solution being provided at the upper part thereof, the planar surface incorporating substantially non smooth resistance means providing a resistance to downward flow of the wash solution and having a capacity to hold wash solution in excess of that of a substantially smooth surface.

Preferably the resistance means comprises a cover of a fibrous material.

Advantageous Effect of the Invention

The invention provides efficient and rapid washing. It further provides mechanical simplicity and low manufacturing costs relative to multi tank processing systems.

A further advantage of the invention is that the wash solution is not retained in tanks between periods of use but is readily removed. The low "holding" volume of the surface relative to a series of tanks allows the solution to be discarded without excessive generation of effluent volume. The short residence time of the solution in the processor means that growth of micro organisms leading to dirt and slime is inhibited.

Brief Description of the Drawings

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an embodiment of the invention; and

Figure 2 is a schematic view of one embodiment of a cover.

Detailed Description of the Invention

Figure 1 is a schematic view of an embodiment of the invention.

Referring to figure 1 there is provided a substantially planar inclined surface 2. An inlet 4 for the introduction of fresh wash solution is located at the

upper end of the inclined surface 2. An outlet 6 for the solution is located at the lower end of the surface 2. The surface 2 is either covered with a material, such as fabric or other material, or has a surface characteristic which provides resistance to flow and a capacity to hold solution. Figure 1 illustrates the surface covered with a fabric. In the case of a fabric cover 8 the surface provides resistance to flow and a capacity to hold solution in the plane of the fabric by soaking up the wash solution within the fibres. This ensures that the solution flows down the plane within the bulk of the fabric cover and not over the surface of the plane in a gap between the plane and the material to be washed, 10, hereinafter referred to as paper, in a way which enables the wash solution to escape from the wash stage before carrying out its washing function. It is important therefore that the capacity of the fabric cover on the plane and the resistance to flow within the fabric cover are such as to enable the wash solution to flow within the bulk of the fabric cover at a flow rate which is consistent with the rate of transport of paper or other washed material and the required efficiency of washing. The fibres further provide agitation which encourages contaminants out of the paper and into the wash solution. The fibres further provide a means of preventing the contaminated solution being dragged up the inclined surface 2 by the paper.

Rollers or other transportation means, not shown, convey the paper to be washed up the inclined surface 2. The paper may be in sheet form or be a continuous web of coated material.

It is desirable in processing equipment which is used only intermittently for the capacity of the fabric cover to be low since the solution would normally drain out of the fabric after a batch of processed material has been washed. The discarded solution would then add to the total liquid effluent produced by the process. This is particularly important if single prints are infrequently processed. Low capacity of the fabric cover results, for a given rate of paper transport and rate of wash solution usage per unit area of paper, in faster flow in linear terms of solution flowing down the inclined surface. The viscosity of the solution combined with the resistance provided by the fabric cover are factors which determine the flow of solution. It is important that these factors are such as to

Claims:

1. A method of washing substances from a coated surface of a material, the material being transported up at least one inclined substantially planar surface and wash solution being introduced at the upper part of the inclined planar surface between the surface and the material, the planar surface incorporating substantially non-smooth resistance means providing a resistance to downward flow of the wash solution and having a capacity to hold wash solution in excess of that of a substantially smooth surface.

2. A method as claimed in claim 1 wherein the resistance means is provided by a cover.

3. A method as claimed in claim 2 wherein the cover is of a fibrous material.

4. A method as claimed in claim 1 wherein the time taken for the wash solution to flow down a length of the inclined surface is between 0.1 and 30 times the time taken for the material to pass up over the same length.

5. A method as claimed in any preceding claim wherein the material being washed is photographic material.

6 Apparatus for washing substances from a coated surface of a material, the apparatus comprising at least one inclined substantially planar surface along which the material is passed, an inlet for the introduction of wash solution being provided at the upper part thereof, the planar surface incorporating substantially non smooth resistance means providing a resistance to downward flow of the wash solution and having a capacity to hold wash solution in excess of that of a substantially smooth surface.

7. Apparatus as claimed in claim 6 wherein the resistance means comprises a fibrous material.

Abstract

Washing Method and Apparatus

A method of washing contaminants from a coated surface of a material transports the material up an inclined substantially planar surface and introduces wash solution at the upper part of the planar surface. The planar surface incorporates substantially non smooth resistance means which provides a resistance to downward flow of the wash solution and has a capacity for holding wash solution which is in excess of that of a substantially smooth surface.

The Inclined Plane

FIG 1

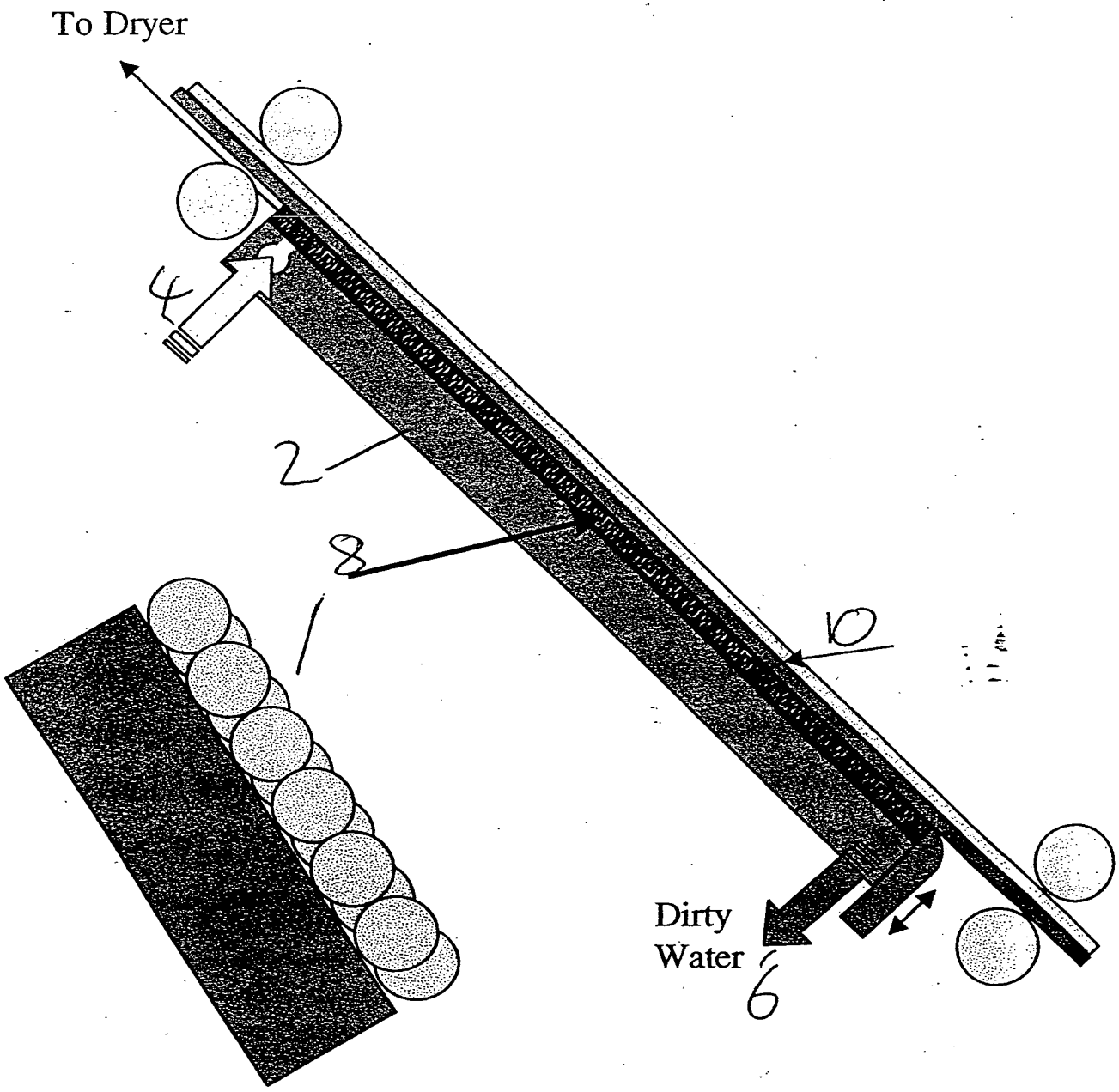

FIG 2